AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listing of claims in the application.

Listing of Claims

1. - 10. (Canceled)

11. (Previously Presented) A computer system comprising:

a host computer; and

a storage system storing data accessed by said host computer;

wherein said storage system includes a first physical storage area in one or more disks in said storage system and a controller for accessing the one or more disks in said storage system,

wherein said first physical storage area corresponds to a first logical volume accessed by said host computer,

wherein said host computer stores data in said first physical storage area, and a backup copy of the data is stored to a tape at a certain point in time,

wherein after said certain point in time, upon occurrence of a failure in a sequence of processing executed by said host computer, said host computer selects an unused second logical volume in said storage system, said second logical volume corresponding to a second physical storage area in said one or more disks, reads the backup copy of the data made at the certain point in time from the tape and writes the backup copy of the data to said second logical volume,

wherein said host instructs said controller to relate said second logical volume in said second physical storage area to said first logical volume in said first physical storage area according to a swap request by exchanging positional information of the first logical volume with that of the second logical volume, so that data of said first logical volume is interchanged with data of said second logical volume and said controller accesses said second physical storage area when said controller receives an access request to said first logical volume from said host computer, and

wherein said storage system sets a value of a device busy request of said positional information of each of said first logical volume and said second logical volume to indicate busy when said storage system receives said swap request from said host computer.

12. (Previously Presented) A computer system according to claim 11,

wherein before receiving said swap request, said controller relates an ID of said first logical volume to an ID of said first physical storage area and accesses said first physical storage area according to an access request including said ID of said first logical volume received from said host computer, and

wherein after receiving said swap request, said controller relates an ID of said first logical volume to an ID of said second physical storage area, and accesses said second physical storage area according to an access request including said ID of said first logical volume received from said host computer.

13. (Canceled)

14. (Previously Presented) A computer system according to claim 11,

wherein said storage system includes plural first physical storage areas, each of which corresponds to a first logical storage area in said first logical volume, and plural second physical storage areas, each of which corresponds to one of said plural first physical storage areas,

wherein said controller stores the backup copy of the data in said plural second physical storage areas, said backup copy of the data stored in the second physical storage area being the data stored in the first physical storage area corresponding to said second physical storage area at the certain point in time,

wherein according to said swap request, said controller relates one of said plural second physical storage areas to a first logical storage area which corresponds to a first physical storage area corresponding to said one of said plural second physical storage areas, so that said controller accesses said one of said plural second physical storage areas when said controller receives an access request to said first logical storage area.

15. (Previously Presented) A computer system according to claim 14,

wherein before receiving said swap request, said controller relates an ID of said first logical volume to IDs of first logical storage areas and IDs of said plural first physical storage areas and accesses one of said plural first physical storage areas according to an access request including said ID of said first logical volume and an ID of a first logical storage area, and

wherein after receiving said swap request, said controller relates said ID of said first logical volume to said IDs of said first logical storage areas, an ID of at least one of said plural first physical storage areas, and an ID of said one of said plural second physical storage areas, and accesses said one of said plural second physical storage areas according to an access request including said ID of said first logical volume and an ID of a first logical storage area corresponding to said ID of said one of said plural second physical storage areas.

16. (Previously Presented) A storage system coupled to a computer, comprising:

at least one disk,

a controller coupled to said at least one disk;

a first physical storage area in the at least one disk; and

a second physical storage area in the at least one disk;

wherein said first physical storage area corresponds to a first logical volume accessed by said computer,

wherein backup data is stored to a tape, said backup data being a copy of data stored in said first physical storage area at a certain time,

wherein after said certain point in time, said controller updates data stored in said first physical storage area according to an access request to said first logical volume from said computer,

wherein said computer upon occurrence of a failure in a process executed by said computer after said certain point in time, selects an unused second logical volume in said storage system, said second logical volume corresponding to the second

physical storage area in said at least one disk, and reads the backup copy of the data made at the certain point in time from the tape and writes the backup copy to said second logical volume,

wherein said controller relates said second logical volume in said second physical storage area to said first logical volume in said first physical storage area according to a swap request from the computer by exchanging mapping information of the first logical volume with mapping information of the second logical volume, so that data of said first logical volume is interchanged with data of said second logical volume and said controller accesses said second physical storage area when said controller receives an access request to said first logical volume, and

wherein said controller sets a value of a device busy request of said mapping information of each of said first logical volume and said second logical volume to indicate busy when said storage system receives said swap request from said computer.

17. (Previously Presented) A storage system according to claim 16,

wherein before receiving said swap request, said controller relates an ID of said first logical volume to an ID of said first physical storage area, and accesses said first physical storage area according to an access request including said ID of said first logical volume received from computer, and

wherein after receiving said swap request, said controller relates an ID of said first logical volume to an ID of said second physical storage area and accesses said second physical storage area according to an access request including said ID of said first logical volume received from said computer.

18. (Canceled)

19. (Previously Presented) A storage system according to claim 16,

wherein said storage system includes plural first physical storage areas, each of which corresponds to a first logical storage area in said first logical volume, and plural second physical storage areas, each of which corresponds to one of said plural first physical storage areas,

wherein said controller stores the backup copy of the data in said plural second physical storage areas, wherein the backup copy of the data stored in the second physical storage area is a copy of the data stored in a first physical storage area corresponding to said second physical storage area at the certain point in time,

wherein according to said swap request, said controller relates one of said plural second physical storage areas to a first logical storage area which corresponds to a first physical storage area corresponding to said one of said plural second physical storage areas, so that said controller accesses said one of said plural second physical storage areas when said controller receives an access request to said first logical storage area.

20. (Previously Presented) A storage system according to claim 19,

wherein before receiving said swap request, said controller relates an ID of said first logical volume to IDs of first logical storage areas and IDs of said plural first physical storage areas and accesses one of said plural first physical storage areas

according to an access request including said ID of said first logical volume and an ID of a first logical storage area, and

wherein after receiving said swap request, said controller relates an ID of said first logical volume to said IDs of said first logical storage areas, an ID of at least one of said plural first physical storage areas, and an ID of said one of said plural second physical storage areas, and accesses said one of said plural second physical storage areas according to an access request including said ID of said first logical volume and an ID of a first logical storage area corresponding to said ID of said one of said plural physical second storage areas.

21. (Previously Presented) A storage system coupled to a host computer, comprising:

at least one disk;

a first physical storage area in said at least one disk, said first physical storage area being included in a first logical volume accessed by said host computer,

a second physical storage area included in a second logical volume in said at least one disk; and

a controller coupled to said at least one disk;

wherein a backup copy of data is stored to a tape, said backup copy of data being a copy of data stored in said first physical storage area at a certain point in time, and

wherein said controller accesses said first physical storage area according to an access request to said first logical volume received from said host computer,

wherein, after said certain point in time, when recovery of the data in the first logical volume to the certain point in time becomes necessary, said host computer

selects the second logical volume in said storage system, and reads the backup copy of the data made at the certain point in time from the tape and writes the backup copy to said second logical volume,

wherein after said controller receives a swap request from said host computer, said controller accesses said second physical storage area according to an access request to said first logical volume received from said host computer by exchanging positional information between said first physical storage area and said second storage area with each other so that data of said first logical volume is interchanged with data of said second logical volume, and

wherein said controller sets a value of a device busy request of said positional information of each of said first logical volume and said second logical volume to indicate busy when said controller receives said swap request from said host computer.

22. (Previously Presented) A storage system according to claim 21, wherein said controller relates an ID of said first logical volume to an ID of said second physical storage area according to said swap request, so that said controller accesses said second physical storage area when said controller receives an access request including said ID of said first logical volume after receiving said swap request.

23. (Canceled)

24. (Previously Presented) A storage system coupled to a computer, comprising:

at least one disk;

first physical storage areas in said at least one disk, said first physical storage areas being included in a first logical volume accessed by said computer;

second physical storage areas included in a second logical volume in said at least one disk; and

a controller coupled to said at least one disk;

wherein a backup copy of data is stored to a tape, said backup copy of data being a copy of data stored in said first physical storage areas at a certain point in time, and

wherein said controller accesses one of said first physical storage areas according to an access request to said first logical volume received from said computer,

wherein, after said certain point in time, when recovery of the data in the first logical volume to the certain point in time becomes necessary, said computer selects the second logical volume in said storage system, and reads the backup copy of the data made at the certain point in time from the tape and writes the backup copy to said second logical volume,

wherein after said controller receives a swap request from said computer, said controller accesses one of said second physical storage areas according to an access request to a partial logical storage area in said first logical volume received from said computer and accesses one of said first physical storage areas according to an access request to another partial logical storage area in said first logical volume received from said computer by exchanging positional information between said partial logical storage area and said another partial logical storage area with each other so that data in the partial logical storage area in said first logical volume is interchanged with data in said another partial logical storage area, and

wherein said controller sets a value of a device busy request of said positional information of each of said first logical volume and said second logical volume to indicate busy when said storage system receives said swap request from said computer.

25. (Previously Presented) A storage system according to claim 24, wherein said swap request includes an ID of said first logical volume and an ID of said partial logical storage area in said second logical volume, and said controller relates said first logical volume to one of said second physical storage areas corresponding to said partial logical storage area, so that said controller accesses said one of said second physical storage areas according to an access request to said partial logical storage area in said first logical volume.

26. (Previously Presented) A storage system according to claim 25, wherein said controller relates an ID of said partial logical storage area to an ID of said one of said second physical storage areas according to said swap request, so that said controller accesses said one of said second physical storage areas according to an access request including said ID of said partial logical storage area.

27. (Previously Presented) A method of data recovery in a storage system, said storage system including a first logical volume wherein data stored to said first logical volume is stored to first physical storage areas on one or more storage devices, said storage system including a second logical volume wherein data stored to said second logical volume is stored to second physical storage areas on said one or more storage devices,

said storage system being in operative communication with a host computer that issues read and write requests to the first logical volume, the method comprising:

storing a copy of said first logical volume at a certain point in time to a backup device as a backup copy;

selecting, after said certain point in time, the second logical volume as a recovery target when data recovery of said first logical volume to said certain point in time is desired;

copying the backup copy made at the point in time from the backup device and writing the backup copy to the second logical volume;

receiving a swap request identifying the first logical volume and the second logical volume;

retrieving mapping information for the first logical volume and the second logical volume based upon said swap request, said mapping information specifying mapping of first logical areas of said first logical volume to said first physical storage areas, and second logical areas of said second logical volume to said second physical storage areas;

interchanging the mapping information of the first logical areas of the first logical volume with the mapping information of the second logical areas of the second logical volume so that the first logical areas of the first logical volume map to the second physical storage areas and the data in the first logical areas of the first logical volume is interchanged with the data in the second logical areas of the second logical volume, wherein when the host accesses the first logical areas of the first logical volume, the second physical storage areas are accessed; and

setting a value of a device busy request of said mapping information of each of said first logical volume and said second logical volume to indicate busy when said storage system receives said swap request from said host computer.

28. (Previously Presented) A method according to claim 27, further including a step of

assigning a sequential positive integer identifier to each first logical area and a matching sequential positive integer identifier to each second logical area, wherein said first logical volume and said second logical volume have a matching number of identifiers to enable the interchanging of the mapping information.

29. (Previously Presented) A method according to claim 27, further including a step of

determining whether said first logical volume or said second logical volume is busy with a read or write request, prior to the step of interchanging the mapping information.

30. (Previously Presented) A method according to claim 27, further including a step wherein

the mapping information of the first logical areas that is interchanged with the mapping information of the second logical areas is for only a portion of data stored in said first and second logical volumes, wherein one of said second physical storage areas is accessed according to an access request to one of said first logical storage areas in a first part of said first logical volume, and one of said first physical storage areas is

accessed according to an access request to another one of said first logical storage areas in another part of said first logical volume.